AD-A099 319 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON --ETC F/G 13/13
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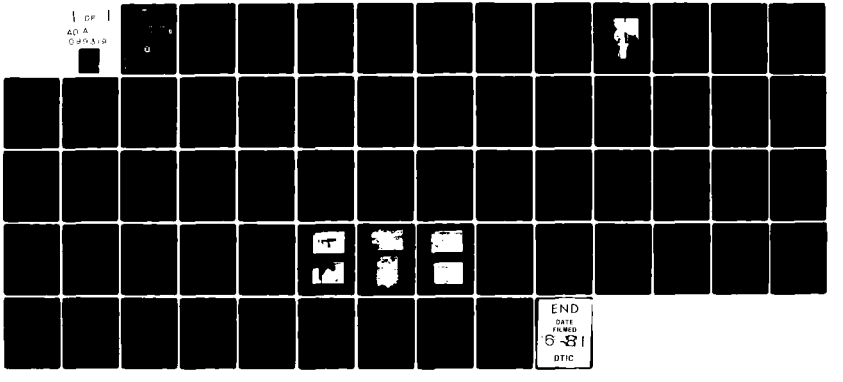

LEVEL II

DELAWARE RIVER BASIN, CHESTNUT BRANCH - MANTUA CREEK, GLOUCESTER COUNTY, NEW JERSEY.

National Dam Safety Program

ALCYON LAKE DAM

NJ 00427

PHASE 1 INSPECTION REPORT- NATIONAL DAM SAFETY PROGRAM

(15) DACW61-79-C-0011

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DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

REPT. NO. (18) DAEN/NAD-(19) 53842/NJ00427-81/05

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Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program
Embankments	Alcyon Lake Dam, N.J.
Visual Inspection	Spillways
Structural Analysis	Riprap

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

(1)

IN REPLY REFER TO
NAPEN-N

15 MAY 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Alcyon Lake Dam in Gloucester County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Alcyon Lake Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillways are considered inadequate because a flow equivalent to 10 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood). The decision to consider the spillways "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillways' adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. Within twelve months from the date of approval of this report, the following remedial actions should be completed:

(1) The downstream slopes in the vicinity of the main spillway wingwalls and the auxiliary spillway outlet should be regraded and further protected with a slope paving.

(2) Place riprap in the spillway outfalls and stilling basin to lessen the undercutting potential.

(3) Rebuild and/or stabilize the CMP road drains at their outlet ends.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Florio of the First District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

ALCYON LAKE DAM (NJ00427)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 4 December 1979 and 10 January 1980 by Louis Berger and Associates, Inc., under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Alcyon Lake Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillways are considered inadequate because a flow equivalent to 10 percent of the Spillway Design Flood - SDF - would cause the dam to be overtopped. (The SDF, in this instance, is one half of the Probable Maximum Flood). The decision to consider the spillways "inadequate" instead of "seriously inadequate" is based on the determination that dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillways' adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. Within twelve months from the date of approval of this report, the following remedial actions should be completed:

(1) The downstream slopes in the vicinity of the main spillway wingwalls and the auxiliary spillway outlet should be regraded and further protected with a slope paving.

(2) Place riprap in the spillway outfalls and stilling basin to lessen the undercutting potential.

(3) Rebuild and/or stabilize the CMP road drains at their outlet ends.

APPROVED: _____
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 15 May 1981

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Alcyon Lake Dam Fed ID# NJ 00427 and NJ ID# 369

State Located New Jersey
County Located Gloucester
Coordinates Lat. 3943.9 - Long. 7508.5
Stream Chestnut Br. - Mantua Creek
Dates of Inspection 4 Dec. 79 & 10 Jan. 80

ASSESSMENT OF GENERAL CONDITIONS

Alcyon Lake Dam is assessed to be in a fair overall condition although additional hydrologic/hydraulic studies should be undertaken in the future to ascertain what improvements can be made to the inadequate spillway. The roadway embankment portion of the dam is of moderate structural concern and the spillway culvert is believed to be in an adequate structural condition. Remedial actions to be undertaken in the future include 1) protect the earth slopes along the downstream wingwalls with additional slope paving, 2) rebuild the catch basin outlets along the roadway gutters 3) remove all dead trees and root systems from the embankment and place riprap in the main spillway outfall.

The capacity of the spillway will accommodate only 9% of the 0.5 PMF design flood and is assessed as inadequate, although not seriously inadequate as failure from overtopping would not significantly increase the hazard to loss of life downstream from that which would exist just before overtopping failure.

Rudolph Wrubel
Vice President
Louis Berger & Associates, Inc.

October, 1979

OVERVIEW OF ALCYON LAKE DAM

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
NAME OF DAM: ALCYON LAKE DAM FED ID# NJ 00427

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with Contract FPM-36 between Louis Berger & Associates, Inc. and the State of New Jersey and its Department of Environmental Protection, Division of Water Resources. The State, in turn, is under agreement with the U.S. Army Engineer District, Philadelphia, to have this inspection performed.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the structural and hydraulic condition of the Alcyon Lake Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

Alcyon Lake Dam is a roadway embankment structure about 480 feet in length with a bridged spillway. The asphalt-paved West Holly Avenue, approximately 30 feet wide, runs along the crest of the dam. The spillway is a concrete three-sided drop inlet structure with two 3'-6" wide wood gates in the front section. The dam has a maximum height of 12 feet and 2H:1V side slopes except for a portion along the upstream face where concrete bulkheads have been constructed. The dam has a 5 foot diameter auxiliary outlet near the left abutment. A shoreline perimeter dike extends along the right shoreline of the reservoir.

b. Location

Alcyon Lake Dam is located in the Borough of Pitman, Gloucester County, New Jersey. The dam lies on West Holly Avenue approximately one mile west of its

intersection with the Woodbury-Glassboro Road (Route 553).

c. Size Classification

The maximum height of the dam is approximately 12 feet and the maximum storage is 150 acre-feet. Therefore the dam is placed in the small size category as defined by the Recommended Guidelines for Safety Inspection of Dams (total impoundment less than 1,000 acre-feet).

d. Hazard Classification

Based on Corps of Engineers criteria and the fact that in the event of a failure, severe damage could occur to several downstream properties together with a potential for loss of more than a few lives, the dam is classified as a high hazard. Immediately below the dam lies a lumber yard which would be directly in the path of any flood. Further, there are sewer, gas and water lines within the embankment which would be disrupted by any serious breaching.

e. Ownership

The roadway embankment and spillway culvert are the property of Gloucester County Road Department which is located on N. Delsea Drive in Clayton, N.J. 08312. However, the original 1941 dam application permit was filed by Alcyon Park Inc. and subsequent repairs were undertaken by that company who originally owned and maintained the lake. Subsequently, the Borough of Pitman has reputedly taken ownership of the spillways and lake bottom. The County may own part of the spillway as the exact position edge of County Right-of-Way could not be determined. Additionally, the Town of Glassboro operates the dam. Thus, it appears there may be joint ownership.

f. Purpose of Dam

The dam impounds an artificial lake which is used solely for public recreation.

g. Design and Construction History

Little is known of the dam's early history except that the present auxiliary spillway contains remains of a pre-World War I power turbine and penstock. The stone masonry foundations are still visible. This turbine provided water power for the adjacent lumber

yard until World War II. The main spillway bridge was erected in 1928 under the supervision of Mr. William C. Cattell, the County Engineer and major alterations were made in 1959 by his successor, Mr. William Baum. The dam was seriously breached in September 1940 and repaired the next year when a perimeter dike was installed along the easterly shoreline and timber sheeting, additional fill and roadway curbs and inlets were built along the upstream crest. Portions of the spillway wingwalls were reputedly rebuilt in about 1950 but there is no evidence of the extent of these repairs. During a storm in 1965, a great deal of the embankment was again washed away and repaired but there were no records of this reconstruction

h. Normal Operating Procedures

The spillway is operated and maintained by the Borough of Pitman while the County Mosquito Commission maintains the downstream channel. (see Section 4).

1.3 PERTINENT DATA

a. Drainage Area

The drainage area for Alcyon Lake Dam is 4.0 square miles.

b. Discharge of Damsite

Spillway capacity at maximum pool (top of dam) elevation - 632 cfs

c. Elevation (Ft. above MSL)

Top of dam (max. pool) - 87.0
Recreation pool (spillway crest) - 84.0
Streambed at centerline of dam - 75± (paved invert)

d. Reservoir

Length of maximum pool - 4,500 feet
Length of recreation pool - 2,500 feet

e. Storage (acre-feet)

Maximum pool (top of dam) - 150
Recreation pool - 66

f. Reservoir Surface (Acres)

Maximum pool - 37
Recreation pool - 19

g. Dam

Type - earth embankment with concrete spillway
Length - 480 feet
Height - 12 feet
Top width - 40 feet (varies)
Side slopes - 2H:1V (varies)
Zoning and core - unknown

h. Diversion and Regulating Tunnel - None

i. Spillway

Type - three-sided narrow crested weir & drop inlet
Length - 35 feet (effective length - 30 feet)
Crest elevation - 84.0 M.S.L.
U/S channel - main reservoir
D/S channel - Chestnut Br. natural channel & auxiliary spillway raceway

j. Regulating Oulets

Type - 3'-6" wide x 8' high timber stoplogs in main spillway plus 8' wide stoplogs in auxiliary spillway.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The only design plans available were the original 1928 foundation plan of the main spillway and the 1941 reconstruction which was prepared by Mr. H.C. Chute, P.E. These indicated the overall height and geometry of the embankment and the extent of the upstream crest reconstruction. It appears that about 100 feet of the embankment was washed out in the 1940 flood but the spillway was not heavily damaged. According to Division of Water Resources records, the concrete inlet and culvert are surrounded by a timber cofferdam. No design analyses or records of any subsurface investigations were located. The predominant soils in the vicinity are composed of recent alluvium sands and silts with discontinuous, intermingled layers of clay and considerable amounts of organic material. The Bridgeton alluvium overlies swampy deposits which are generally encountered at depths less than ten feet. Below this are Cohansey, Kirkwood and Pennsauken sands, extending down to bedrock. Drainage of the foundation soils is usually poor and the depth to bedrock is greater than 50 feet.

The reinforced concrete arch culvert is typical of the type designed by Mr. William Cattell, the County Engineer, in the 1920's and 30's and bears the County identification No. 6-1-1. The culvert is heavily reinforced but no details were available regarding the main steel in the structural arch. No plans or details of the auxiliary spillway concrete inlet or pipe were available. It was noted that they appear considerably older than the main spillway.

2.2 CONSTRUCTION

No data was located regarding who accomplished the initial construction or what records were kept. As portions of the dam have been in private ownership, it is doubtful if any additional records are readily available other than those at the Division of Water Resources.

2.3 OPERATION

The dam has operated as an uncontrolled overflow facility with infrequent regulation of the lake level by use of the 3'-6" wide sluice gates (see Section 4).

2.4 EVALUATION

a. Availability

In the opinion of the inspection team, sufficient engineering data is available to determine the structural adequacy of the two spillways. No data was acquired upon which to base an assessment with regards to the embankment composition or zoning. However, except for the zone immediately to each side of the spillway, this is not particularly relevant as the embankment is extremely wide in relation to its height.

b. Adequacy

The engineering data relating to the dam is regarded as adequate to render the following assessment without recourse to gathering further information.

c. Validity

The validity of the data is not challenged as the inspection revealed it exists substantially as designed and recorded.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

Visual inspections were conducted on December 4, 1979 and January 10, 1980 at which time a stable reservoir condition was maintained. The tops of the flashboards at the main spillway and the stoplogs at the auxiliary penstock inlet are at roughly the same elevation and were discharging about 2 inches of flow.

b. Dam

The roadway embankment which forms the major portion of the dam was found to be in a stable condition. The low point of the road profile is located to the right of the main spillway and it was noted that any flows over the crest could be concentrated in this area. Proceeding towards the left abutment zone, the crest rises approximately two feet. The roadway is asphalt paved and is in good condition although the shoulders are eroded and sloughed off near the edges. The sideslopes are irregular and there is some erosion at the downstream wingwalls. There is a substantial amount of broken concrete riprap placed along the upstream face and low timber bulkhead to the right of the main spillway. There are several 2 to 6 inch trees and brush with a chainlink fence installed along sections of the dam (see appended photographs). There are several larger trees on the downstream slopes. Much of the downstream slope erosion is due to run-off from the roadway pavement and several drains have been placed at the downstream wingwalls to prevent further erosion. The downstream slopes are not well maintained.

A curb extends along the outside edge of the sidewall along the upstream crest (which may be the top of a structural retaining wall that may have been installed in 1941 to raise the dam crest elevation. The upstream slope is quite irregular and it appears the lake has silted up considerably against the upstream dam face except in the vicinity of the rain spillway.

c. Appurtenant Structures

The reinforced concrete main spillway arch culvert is in excellent structural condition in view of its age. The wingwalls and parapets display minor cracking and spalled areas but the structurally important zones are in an integral condition and recently painted. The semi-circular culvert opening has a clear span of 16 feet. The headroom above the paved invert is about 8 feet and there is a two to three foot drop at the outlet edge onto the natural stream bed. The spillway drop inlet is a three-sided reinforced concrete wall connected to the bridge wingwalls. The middle section is 15 feet wide with each return measuring 10 feet. The top of the weir is spalled but is in an integral condition. The vertical-lift sluicegates are serviced from a small concrete platform which extends out from the culvert fascia. The gate is divided into two sections and is mounted on a steel frame comprised of 3 inch ship channels with a top frame to support a come-a-long for emergency lifting or removal. Although the gate was submerged it appears to be approximately 3'-6" feet wide and 8 feet deep and is operable.

The flared wingwalls are apparently the 1950 replacements for the originally walls which paralleled the centerline of roadway and dam axis. The paved invert of the outlet structure rests on timber mudsills and a rather unique hinged discharge apron is affixed to the trailing edge of the invert slab grade beam. This "flow door" is in remarkably good condition and effectively has limited the undercutting of the downstream channel. However, there is considerable erosion around the downstream wingwalls.

The auxiliary spillway is a 5'-0" diameter steel pipe with an irregular concrete inlet which is blocked up by stoplogs to El. + 84. The pipe appears to be partially blocked up and the stoplogs appear to be immovable. The penstock discharges into the foundations of an old millhouse and hence into a concrete lined millrace which extends about 150 feet downstream.

There are several concrete flumes that extend from the upstream curbline and drain back into the reservoir. All were originally equipped with hinged

timber tide gates to prevent high reservoir heads from flowing onto the crest. All are now blocked or inoperable.

d. Reservoir Area

The lake has a regular, well-defined shoreline that extends upstream to the headwaters in the natural streambed. The reservoir is almost entirely bounded with residential development and municipal parkland and is clear of debris. There is little evidence of silting except immediately adjacent to the dam face. There is a low sea wall along the east shoreline which was apparently erected in 1941 after this area was overtopped. This area immediately above the intersection of Holly Avenue and Cedar Street appears to lie slightly below the dam crest and appears to be flooded whenever the dam or perimeter dike is overtopped.

e. Downstream Channel

After discharging through the study dam, the Chestnut Branch flows 1,800 feet northwest where it crosses under Lambs Road in a fair sized rectangular culvert. The channel is narrow but well-defined and the overbank flood zones are heavily wooded. The channel is poorly maintained and is partially blocked with vegetation and fallen trees. The downstream flood plain is used unofficially as a park but is presently undeveloped for the most part.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

Operational procedures were not physically observed by the inspection team. Discussions were held with personnel of the Robbins Lumber Company who informed the inspection team that the regular maintenance of the culvert and crest roadway is handled by Gloucester County.

4.2 MAINTENANCE OF DAM

The main spillway culvert is maintained by Gloucester County in a workmanlike fashion as part of their continual road program. The chain-link fence and upstream shorelines are apparently maintained by Borough maintenance forces.

4.3 MAINTENANCE OF OPERATING FACILITIES

The only operating facility is the twin sluicegate which is operated and maintained by the Borough. Their representatives stated that repairs are undertaken on an as-needed basis.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

None exists except for monitoring by County and local Municipal personnel during heavy storms. The sluicegates are adjusted during heavy storms to prevent flooding of the low-lying areas around the lake, especially towards the east.

4.5 EVALUATION

The present operations are deemed to be adequate in view of the height of the dam. There are no records of serious overtopping since 1965. The upkeep of the spillway and shorefront along the upstream face is satisfactory and silt is periodically removed when the lake is lowered. As previously stated, the maintenance of the downstream embankment slopes appears to have been neglected in recent years.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data

Based on the criteria in the Recommended Guidelines for Safety Inspection of Dams, Alcyon Lake Dam is small in size but is placed in the high hazard category. One half the probable maximum flood was selected as the design storm by the inspecting engineers. Precipitation data was obtained from Hydrometeorological Report #33. The inflow hydrograph and reservoir routing were calculated utilizing the HEC-1 computer program. The discharge for the SDF was calculated to be 6,927 cfs. With a spillway capacity before overtopping of 632 cfs, the dam can accommodate only 9% of the design flood and is adjudged to be inadequate (see Section 7).

b. Experience Data

Records indicate that two large sections of the dam were washed out in a storm on September 1, 1940. Since then, inspection reports indicate that there was a breaching in 1965 when about one half of the embankment was washed away.

c. Visual Observations

The dam appears to have been and remains a potential flooding problem but has caused little damage in the past except to the structure itself and the lumber yard facilities immediately below the crest. It appears that severe storms in 1967 did not cause serious damage although the dam was overtopped.

d. Overtopping Potential

The appended hydraulic analysis indicates a considerable potential exists for continued overtopping, due principally to lack of sufficient freeboard and the limited spillway capacity. The design flood would overtop the irregular dam crest by approximately 2 feet.

e. Drawdown

Drawdown is provided by opening the two vertical lift wood sluicegates in the main spillway. Assuming no tailwater or inflow, it would take approximately 3/4 of a day to dewater the lake. Due to the heavy silting it is presently impractical to utilize the stoplogs in the auxiliary spillway entrance.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

Based upon the inspection of existing conditions and the partially complete source of design plans, the dam embankment and roadway culverts are deemed to be in a good to fair condition except for the continual maintenance problem of roadway surface drainage and the irregular crest elevation. Although no serious hazard is foreseen, a collapse of the principal spillway could choke up the culvert opening and create a hydraulic blockage which would be difficult to clear during periods of heavy flow. The roadway embankment is quite wide in relation to its height and as a water-impounding structure, has adequate stability although the few trees and root systems should be removed. Overtopping could cause a washout of the downstream road shoulders and sideslopes along the culvert wingwalls and the lower crest areas near the right abutment. Because of the irregular road profile, the overflow would be concentrated in several areas to the right of the spillway and could possibly cause a breaching, similar to that which previously occurred in this area.

Although no evidence of serious seepage was observed, the downstream condition of the 5 foot diameter penstock pipe (which serves as an auxiliary spillway) could trigger piping problems along the conduit. There is no downstream headwall or any type of anchorage supporting this conduit and it is doubtful if this outlet could withstand extended periods of heavy flow. From the appearance of the stoplogs in the inlet, this conduit has not been touched or maintained in many years.

It was noted that several of the headwalls of the corrugated metal pipe street drains have been demolished by heavy flooding and substantial lengths of the pipe exposed.

The shoulder/crest areas along the roadway including sidewalls and curbs, show considerable evidence of differential settlement but most appear to be localized problems and not the result of hydraulic migration of fines. In several areas, the installation or repair of the various utilities could be the cause of this settlement. The curb inlets which discharge into the lake are of little consequence although the timber tide gates are missing within the concrete flumes.

b. Design and Construction Data

Although no hydraulic or structural computations were located, a review of the original plans indicates that the concrete intake structure and arch culvert were conservatively designed and in spite of their age and previous failure of the wingwalls, are believed to be adequate insofar as stability and strength are concerned. The inspection team noted that the original wingwalls (which paralleled the dam axis) have been replaced by the flared walls but the reason for this modification is unknown. It appears these wings collapsed in the 1940 flood, or possibly in 1950.

c. Operating Records

No records are available but the dam appears to be operating satisfactorily. There are no known instances since 1965 where overtopping caused any appreciable damage but there are no recent records of floods or inspection reports at the Division of Water Resources.

d. Post Construction Changes

The most recent post-construction changes in evidence are the 1950 and 1959 installation of wingwalls. However, there has been a variety of drainage control devices installed along the road shoulders to channelize the surface run-off (which appears to be a continual maintenance problem). The inspection team was informed that the County has already prepared design plans for rebuilding the spillway; hence, more recent hydraulic studies would be assumed to be part of this design. Consequently, the recommendations regarding further studies set forth in Section 7 should interface with this design currently in progress.

e. Seismic Stability

The dam is located in Seismic Zone 1 and due to its embankment width and spillway geometry, has negligible vulnerability regarding earthquake loading intensities as it is statically stable. Experience indicates that dams in Zone 1 will have adequate stability under dynamic loadings if stable under static loading conditions.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS, REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

Subject to the inherent limitation of this Phase I visual inspection, the Lake Alexander Dam is classified as being in a fair overall structural condition although the spillway overflow weir and digression culverts are incapable of passing the design flood. The dam embankment is built of unknown composition but due to its low height, broad width, and timber cut-off walls at the main spillway outlet is felt to be of a sufficient impervious condition to withstand all normal hydraulic heads. The present spillway capacity is inadequate and does not meet the requirements of the Recommended Guidelines for Safety Inspection of Dams, being able to accommodate only 9% of the 1/2 PMP design flood as calculated by Corps of Engineers criteria. The SDF is calculated to overtop the dam by 2 feet at the low point along the roadway.

b. Adequacy of Information

The information gathered for the Phase I inspection is deemed to be adequate regarding the structural stability of the dam. However, no recent surveys or inspections have been made.

c. Urgency

It is recommended that further studies and the remedial measures enumerated below be undertaken in the future, after a review of the plans prepared by Gloucester County for reconstruction of the main spillway.

d. Necessity for Further Study

In view of the inability to discharge the design flow, further hydraulic and hydrologic studies are recommended in conjunction with the County's prepared designs to ascertain what feasible methods could be employed to alleviate the substandard hydraulics. In its present condition, the dam is subject to continued overtopping and potential damage to the structure itself.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

a. Recommendations

On the basis of this inspection, it is recommended that the County review its new spillway design, incorporating, if necessary, the Corps of Engineers' hydraulic and hydrologic criteria. Upon completion of the new design, reconstruction of the spillway should be performed and its capacity increased sufficiently to accommodate the spillway design flood. The downstream slopes in the vicinity of the main spillway wingwalls and the auxiliary spillway outlet should be regraded and further protected with slope paving. Other remedial measures to be taken under advisement include:

1. place riprap in the spillway outfalls and stilling basin to lessen the undercutting potential,

2. rebuild and/or stabilize the CMP road drains at their outlet ends,

b. O&M Maintenance and Procedures

No additional procedures other than those presently in effect appear to be warranted until such time as further studies are completed. The Borough maintenance forces are cognizant of their responsibilities and appear to do an excellent job, however, the Borough should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam. It is further recommended that the owners prepare an emergency action plan and downstream warning system to minimize the potential effects of a dam failure.

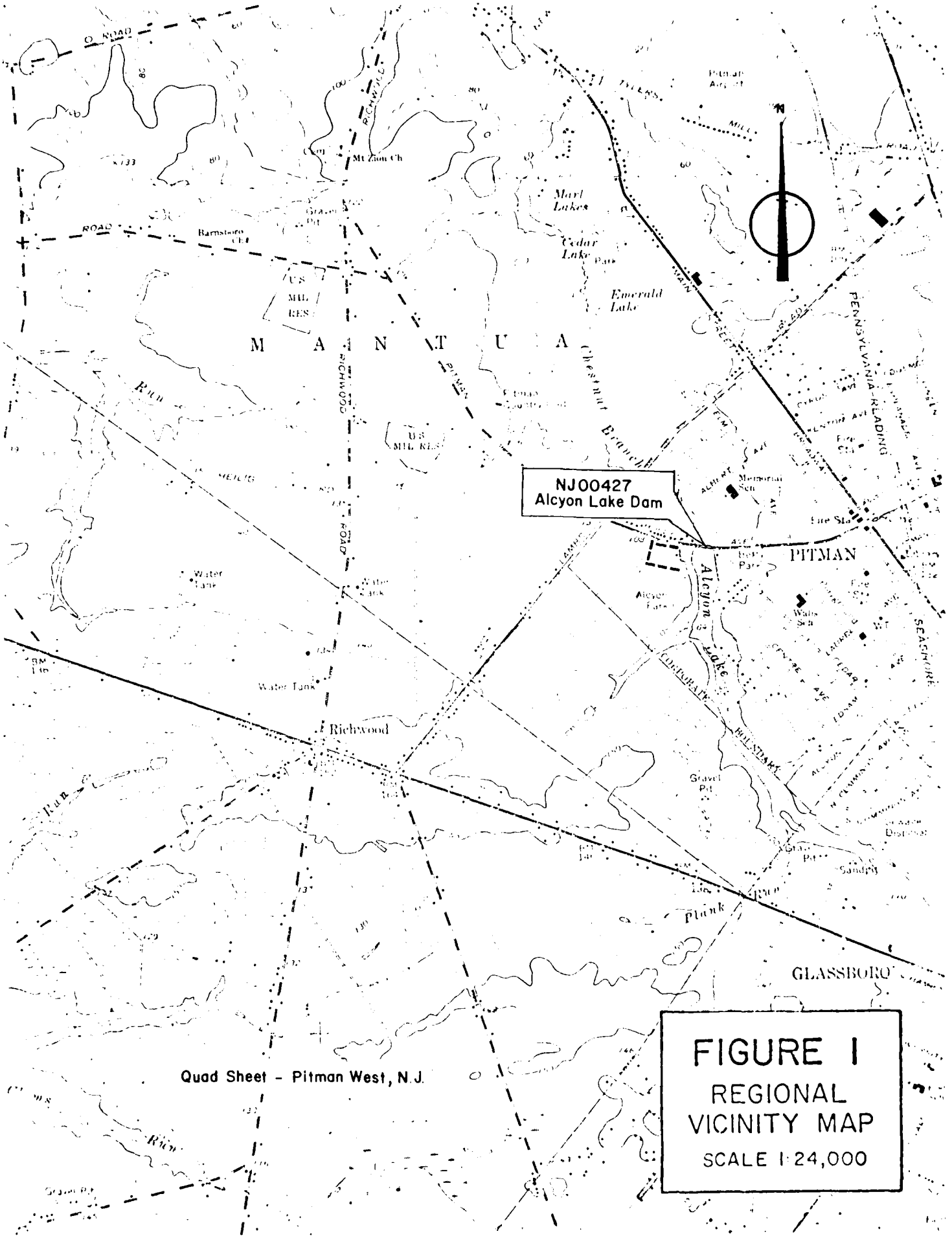
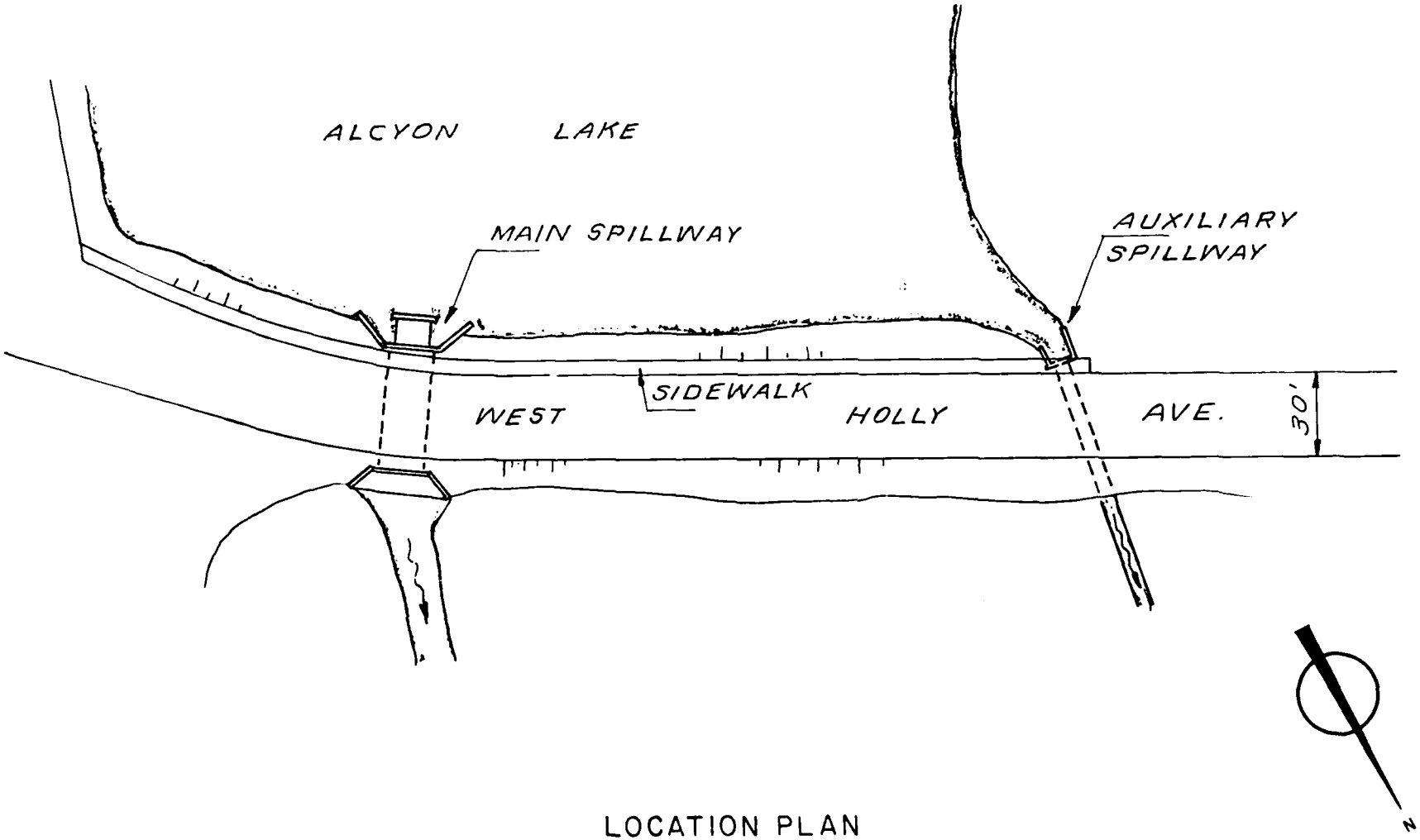
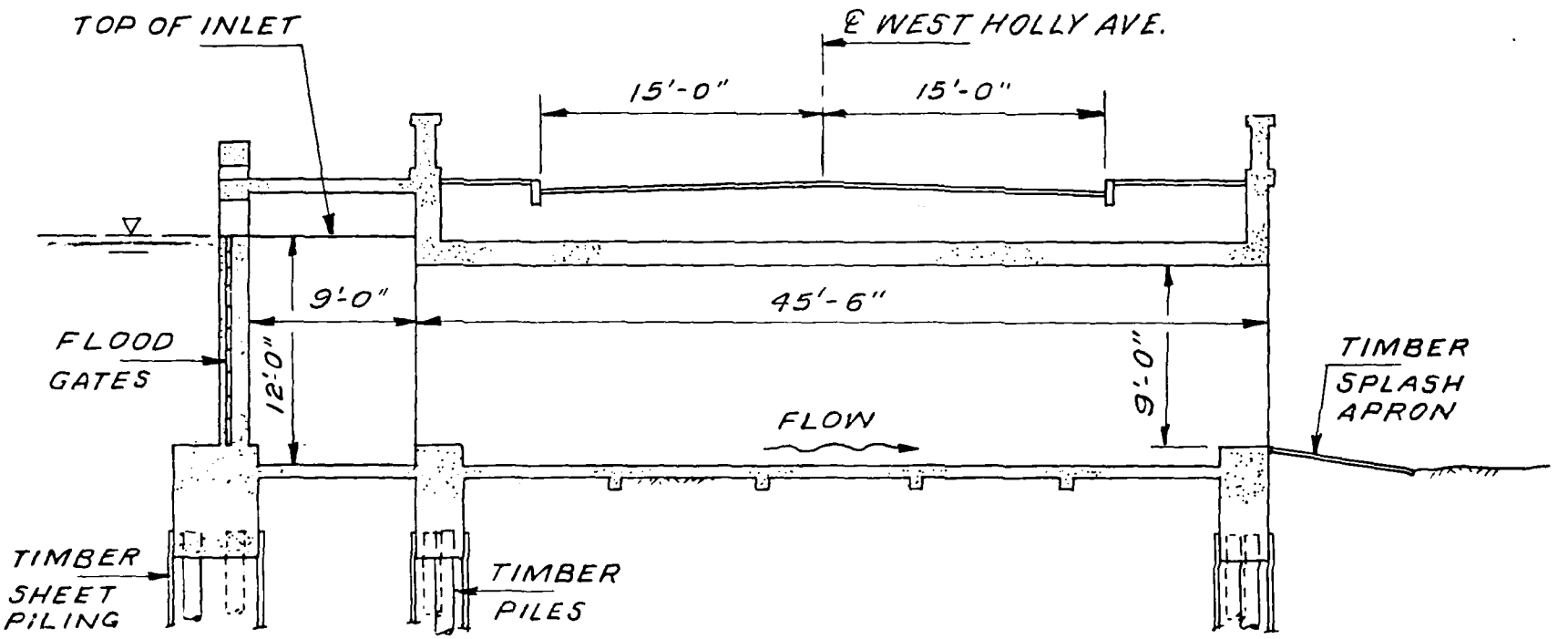


FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24,000



LOCATION PLAN
NOT TO SCALE

FIGURE 2



SECTION THRU SPILLWAY

NOT TO SCALE

FIGURE 3

Check List
Visual Inspection
Phase 1

Name Dam Alcyon Lake County Gloucester State N.J. Coordinators NJDEP

Date(s) Inspection 12-4-79 1-10-80 Weather Cloudy Temperature 40°F

Pool Elevation at Time of Inspection 84.2 M.S.L. Tailwater at Time of Inspection 75± M.S.L.

Inspection Personnel:

L. Baines J. Voorhees

M. Carter K. Jolls

D. Lang

D. Lang Recorder

EMBANKMENT DAMS
CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEE PAGE ON LEAKAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Roadway embankment. Junctions good. Concrete curb and gutter along lake side and in places on north side with extruded asphalt and catch basins.	Bridge alterations in 1959 Wm. H. Baum, County Engr. J.R. Williams Inc., Contractor. Originally built in 1928
DRAINS	Weep holes in wingwalls.	
WATER PASSAGES	Two roadway storm sewer pipes which discharge downstream of bridge.	
FOUNDATION	See plans, timber piling.	

EMBANKMENT DAMS
CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	None seen in main spillway. Concrete appears to be well maintained, recently whitewashed.	
STRUCTURAL CRACKING	None	
VERTICAL AND HORIZONTAL ALIGNMENT	Horizontal alignment good. Vertical alignment of main spillway dips towards the east approximately 2 inches. Water flows over left side of spillway and not over right.	
MONOLITH JOINTS	Satisfactory	
CONSTRUCTION JOINTS	Satisfactory	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None. County roadway surface. There is evidence of asphalt patchings and overlays.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None. Lumber yard built into downstream embankment.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Erosion from surface runoff and pedestrian traffic behind wingwalls on downstream side.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Good - roadway embankment. Concrete sidewalk on upstream embankment is irregular in elevation at joints in slabs.	
RIPRAP FAILURES	Concrete scraps placed on upstream face and behind wingwalls. Failure behind wingwalls.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good, except for erosion behind wingwalls.	
ANY NOTICEABLE SEEPAGE	None	
STAFF GAGE AND RECORDER	None located	
DRAINS	Roadway drop inlet	

OUTLET WORKS (Auxiliary Spillway)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Once led into gristmill. Timber flashboards are in fair condition.	
INTAKE STRUCTURE	Flows through 60" pipe concrete in good condition.	
OUTLET STRUCTURE	Main spillway - 10' long timber splash apron. Hinged and in good condition.	
OUTLET CHANNEL		
EMERGENCY GATE		

UNGATED SPILLWAY (AUXILLIARY)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good horizontal alignment.	Minor debris on crest should be removed.
APPROACH CHANNEL	Lake Reservoir.	
DISCHARGE CHANNEL	Auxiliary - abandoned millrace.	
BRIDGE AND PIERS	Concrete bridge structure incorporated with spillway. #6-1-1	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL		
APPROACH CHANNEL	Main lake reservoir	
DISCHARGE CHANNEL	See downstream channel section	
BRIDGE AND PIERS	Concrete bridge structure incorporated into spillway.	
GATES AND OPERATION EQUIPMENT	Gates operable.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Flat on east side. Park area appears lower than water level. West side rises 1V:2H up to apartments 25' above lake. Present freeboard about 2'±	
SEDIMENTATION	Evident around spillway structures and all along upstream face.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	5' diameter cast iron pipe enters from southeast. Possibly a storm sewer.	
SLOPES	Steep 1:1 concrete rubble. Appears to be dumping ground. 8" water line approximately 120± feet downstream across channel.	
APPROXIMATE NO. OF HOMES AND POPULATION	School (on higher ground and 250 yards away).	

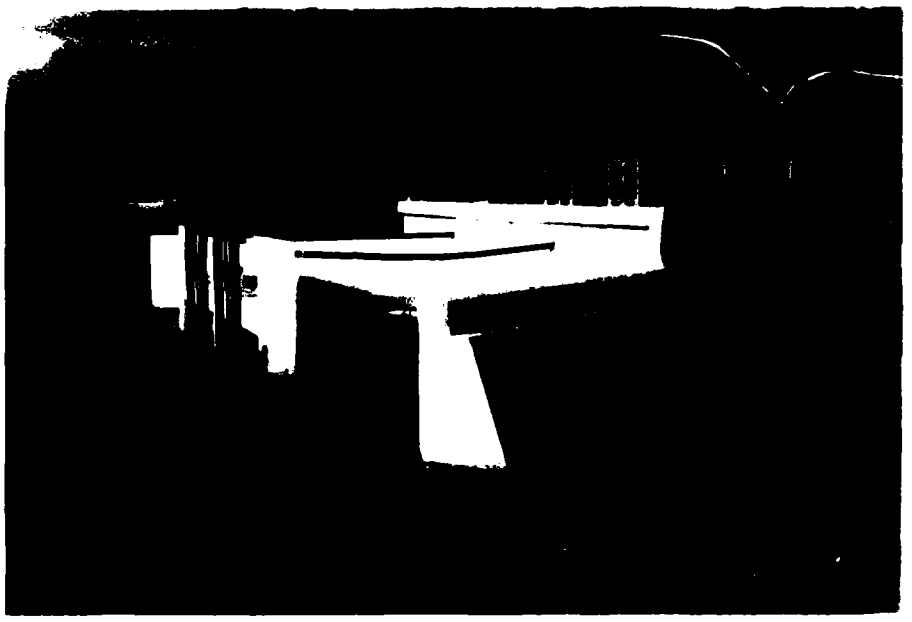
CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Available - NJDEP - Div. of Water Resources - Bureau of Flood Plain Management.
REGIONAL VICINITY MAP	Available - U.S.G.S. Quad - Pitman West, N.J.
CONSTRUCTION HISTORY	Some information available (NJDEP)
TYPICAL SECTIONS OF DAM	Available (NJDEP)
HYDROLOGIC/HYDRAULIC DATA	Not available
OUTLETS - PLAN	None available
- DETAILS	None available
-CONSTRAINTS	Unknown
-DISCHARGE RATINGS	None available
RAINFALL/RESERVOIR RECORDS	None available

ITEM	REMARKS
SPILLWAY PLAN	Auxiliary spillway plan available (NJDEP)
SECTIONS	Not available
DETAILS	Not available
OPERATING EQUIPMENT PLANS & DETAILS	Not available

ITEM	REMARKS
DESIGN REPORTS	None available
GEOLOGY REPORTS	None available
DESIGN COMPUTATIONS	Not available
HYDROLOGY & HYDRAULICS	Not available
DAM STABILITY	Not available
SEEPAGE STUDIES	Not available
MATERIALS INVESTIGATIONS	Not available
BORING RECORDS	None available
LABORATORY	Not available
FIELD	Not available
POST-CONSTRUCTION SURVEYS OF DAM	None available
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	September 1940 Brief description of 1940 failure (NJDEP) None available
MAINTENANCE OPERATION RECORDS	None available



December, 1979

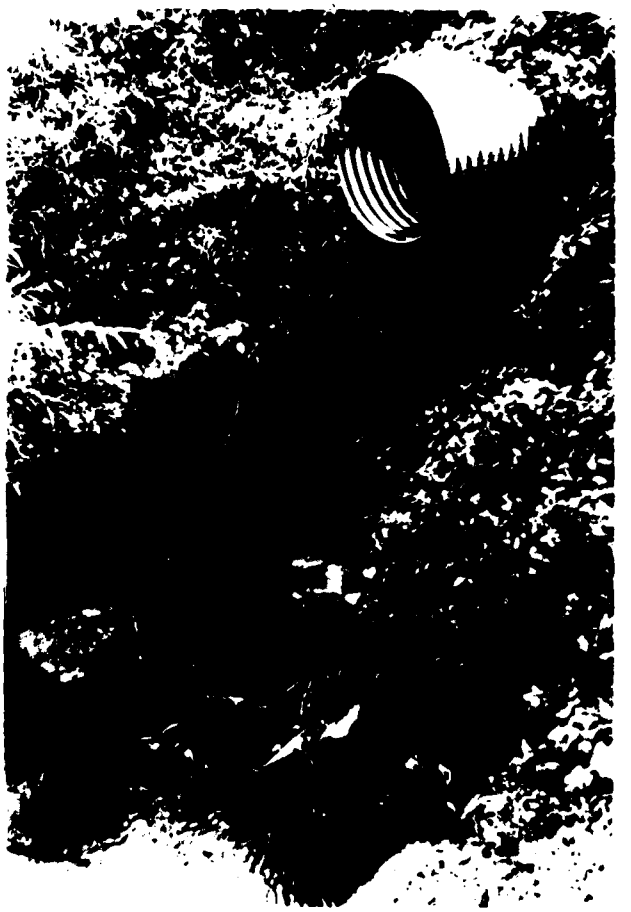
View of main spillway inlet

December, 1979

View of main spillway outlet

December, 1979

View of auxiliary spillway inlet

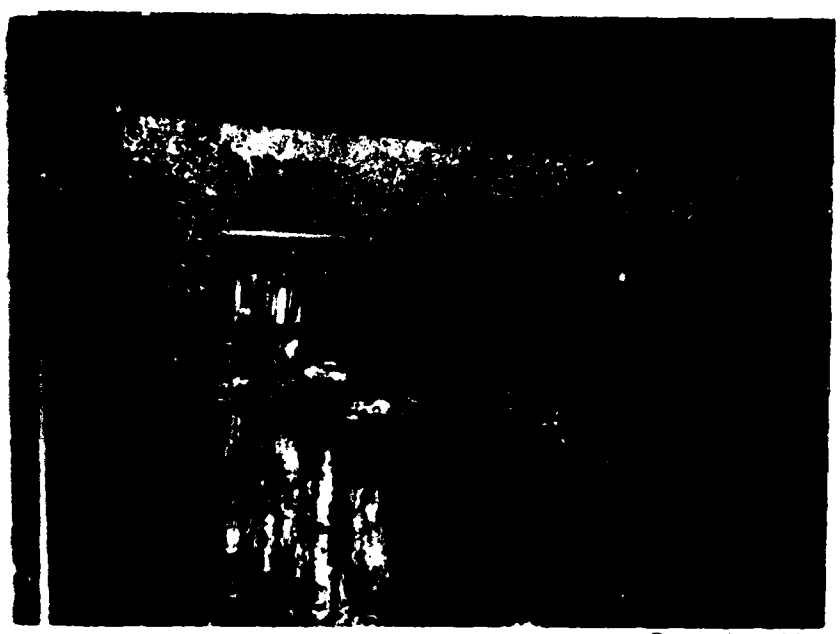


December, 1979

View of auxiliary spillway outlet

December, 1979

View of downstream channel of main spillway



December, 1979

View of downstream channel of auxiliary spillway

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 4.0 square miles

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 84 MSL (66 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): _____

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 87 MSL (150 acre-feet)

CREST: _____

a. Elevation 87 MSL
b. Type Earth embankment with concrete drop inlet spillway
c. Width 40 feet (varies)
d. Length 480 feet
e. Location Spillover
f. Number and Type of Gates

OUTLET WORKS: Main spillway

a. Type Three-sided narrow crested weir and drop inlet
b. Location Near right abutment
c. Entrance inverts 84 MSL
d. Exit inverts 75± MSL
e. Emergency draindown facilities 2-timber gates 3'-6"

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 632 cfs

BY _____ DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO _____ OF _____

CHKD. BY _____ DATE _____ _____ PROJECT _____

SUBJECT _____

TIME OF CONCENTRATION

LENGTH ALONG WATERCOURSE TO DELAWARE DIVIDE = 15,000 FT
= 2.84 MI

$\Delta H = 144 - 84 = 60$ FT

SLOPE $\frac{60 \text{ FT} \times 100}{15{,}000 \text{ FT}} = 0.4\%$ AT SOME POINT = 2%

$t_c = \frac{15{,}000 \text{ FT}}{2 \times 2{,}000} = 2.08$ HRS

BY CALIFORNIA CULVERTS METHOD

$t_c = \left[\frac{11.9 L^3}{H}\right]^{.385} = \left[\frac{11.9(2.84)^3}{60}\right]^{.385} = 1.74$

USE AVERAGE $T_c = 1.94$ HRS

$T_p = \frac{0.5}{2} + 0.6(1.94) = 1.41$ HRS

BY L.C. DATE 4/[illegible]

CHKD. BY _____ DATE _____

SUBJECT _____

LOUIS BERGER & ASSOCIATES INC.

SHEET NO 1 OF

PROJECT [illegible]

DRAIN[illegible] AREA = 4.[illegible] Sq. Miles

$$Q_p = \frac{484 (A)(Q)}{T_p} = \frac{484 (4.[illegible])}{1.41} = 13[illegible]$$

UNITGRAPH

TIME (HRS)	T/Tp	DIMENSIONLESS CURVATE (Q/Qp)	Q CFS Qp x [illegible]
0.5	0.35	0.[illegible]	20.[illegible]
1.0	0.71	[illegible]	10[illegible]
1.5	1.06	[illegible]	13[illegible]
2.0	1.42	0.73[illegible]	[illegible]
2.5	1.77	0.[illegible]	[illegible]
3.0	2.13	0.[illegible]	[illegible]
3.5	2.[illegible]	0.[illegible]	[illegible]
4.0	2.[illegible]	[illegible]	[illegible]
4.5	3.19	[illegible]	[illegible]
5.0	3.55	[illegible]	[illegible]
6.[illegible]	3.90	[illegible]	
6.[illegible]	4.[illegible]	0.0138	[illegible]

[illegible]

[illegible] = [illegible]

BY KEE DATE 7-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO 43 OF

CHKD. BY DATE Alcoa Lake Dam PROJECT

SUBJECT

Elevation

Probable Maximum Precipitation for 100 sq mi
Area and 24 hr period = 24.0 inches

Maximum 6 hour precipitation = 11.8 %

Maximum [illegible] = 12.7 %

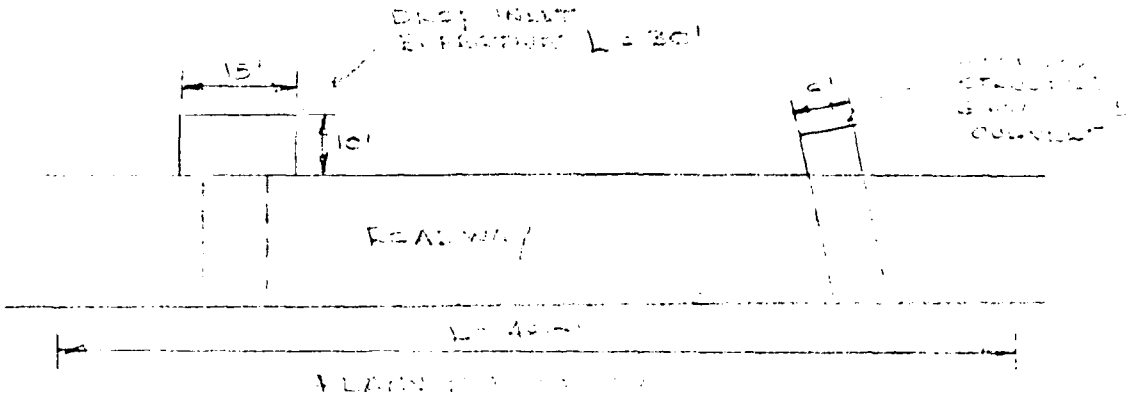
Maximum [illegible] = 13.2 %

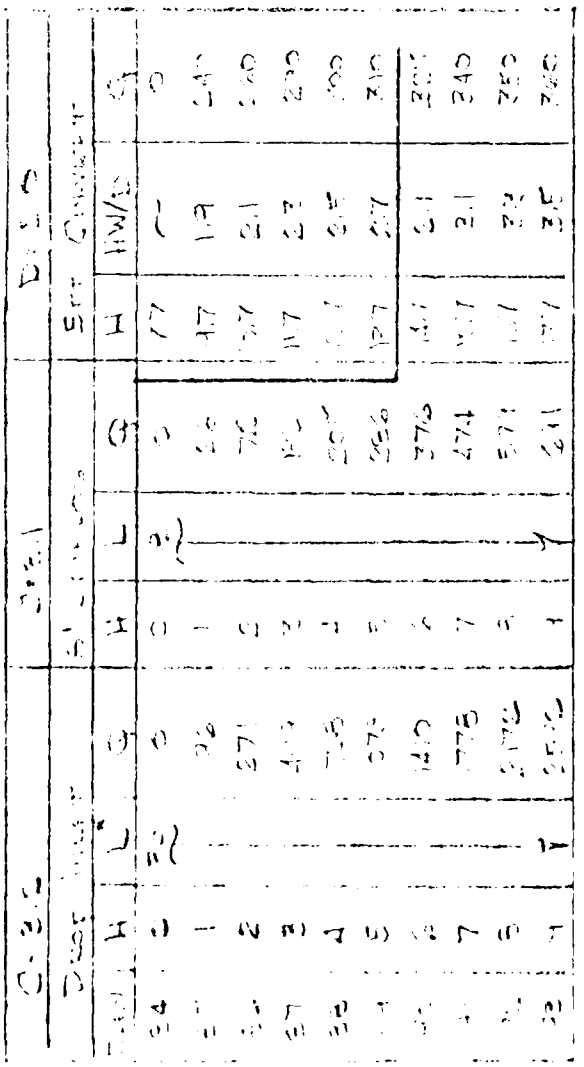
Maximum [illegible] = 14.1 %

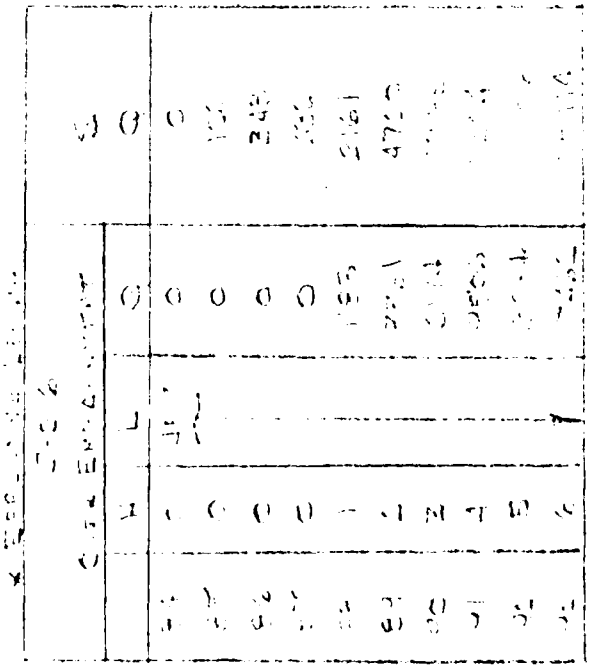
BY _____ DATE _____ **LOUIS BERGER & ASSOCIATES INC.** SHEET NO _____ OF _____

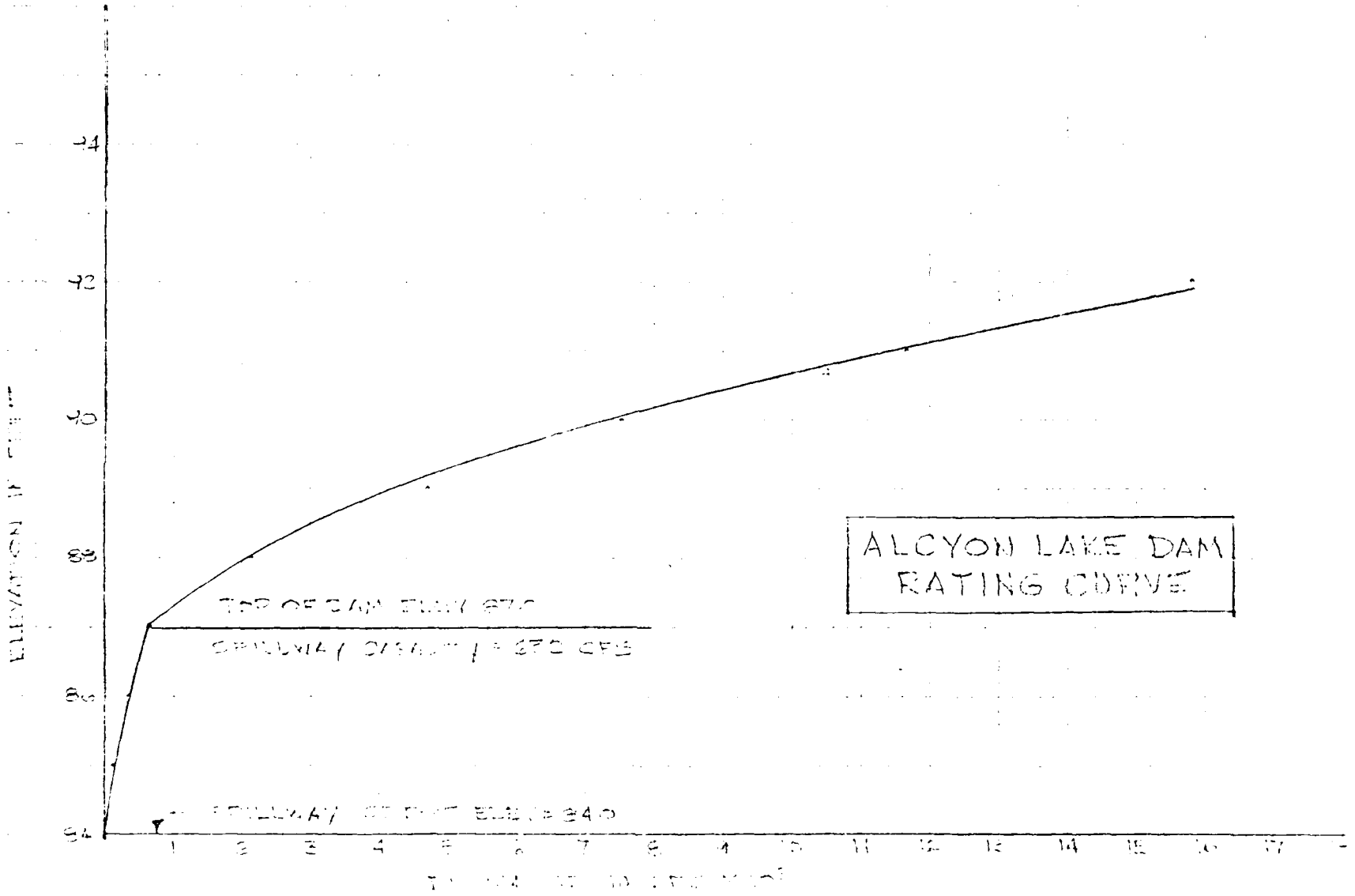
CHKD. BY _____ DATE _____ _____ PROJECT _____

SUBJECT _____








ALCYON LAKE DAM
RATING CURVE

BY L.L.B. DATE 1-18-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO A.C. OF

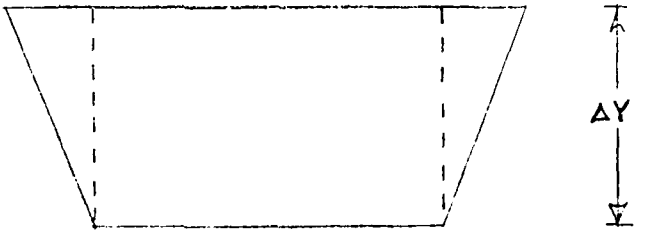
CHKD. BY ____ DATE ____ ALCYON LAKE DAM PROJECT ____

SUBJECT STORAGE CAPACITY

AREA OF LAKE @ ELEV. 84.0 = 19 ACRES

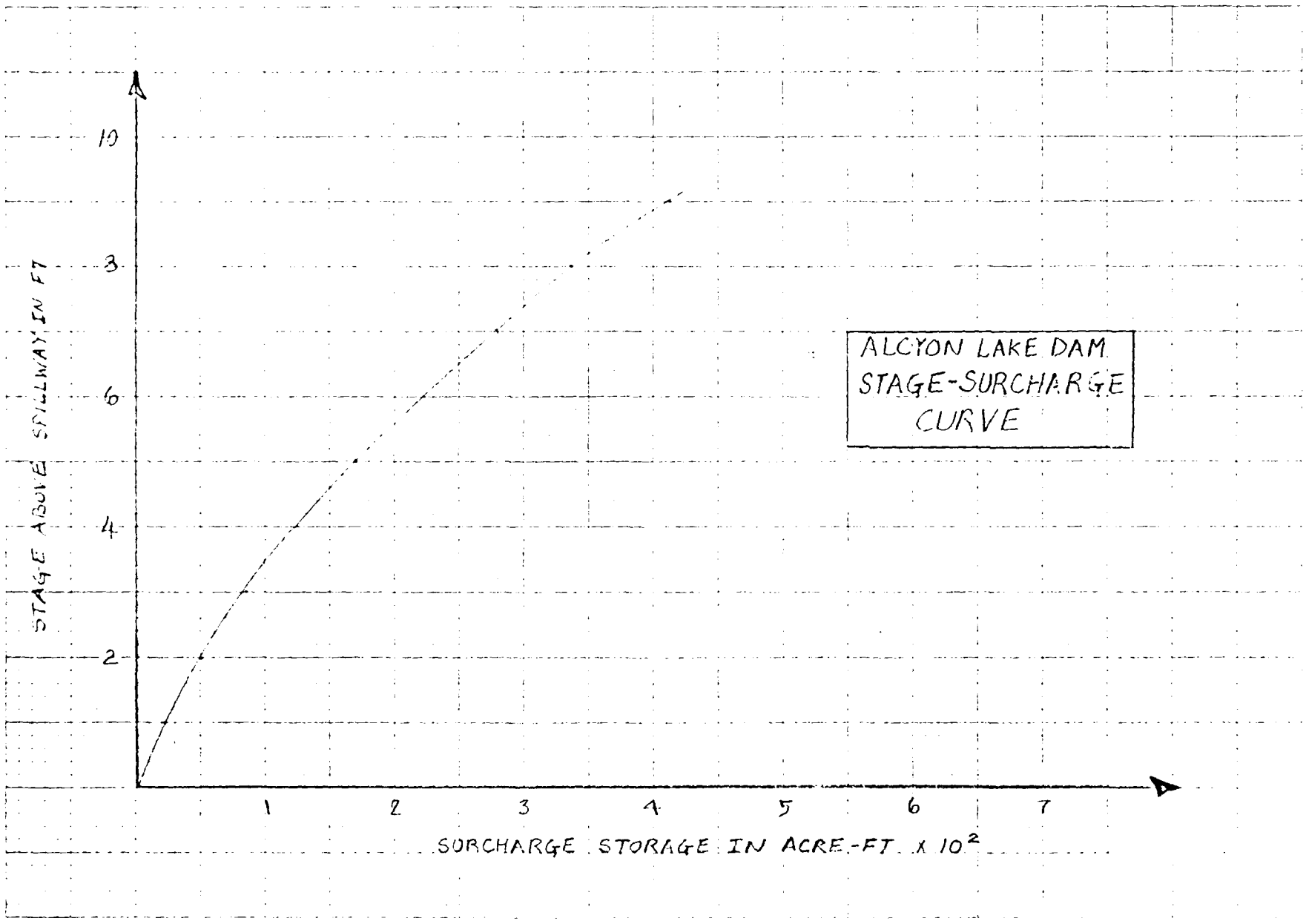
AREA OF 90 FT CONTOUR 54.8 ACRES

ASSUME POOL AREA ABOVE 90 FT CONTOUR PROJECTS AT SAME RATE



$$\Delta V = \Delta Y (X + \Delta X)$$

HEIGHT ABOVE SPILLWAY CREST	A ACRES	Δ V.L.	SURCHARGE STORAGE ACRE-FEET
0	19.0		0
1	25.0	22.0	22
2	30.9	25.0	50
3	36.9	28.0	84
4	42.9	30.9	124
5	48.8	33.9	170
6	54.8	36.9	221
7	60.8	39.9	279
8	66.7	42.9	343
9	72.7	45.9	413


ALCYON LAKE DAM
STAGE-SURCHARGE
CURVE
STAGE ABOVE SPILLWAY IN FT
10
8
6
4
2
1
2
3
4
5
6
7
SURCHARGE STORAGE IN ACRE-FT. X 10²

BY RTH DATE 1-15-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. A8 OF

CHKD. BY DATE Appendix A: Dam PROJECT

SUBJECT Analysis of Spillway Discharge

FLOW THROUGH SPILLWAY THROUGH SPILLWAY
ONLY, WITH NO STORAGE AKA RUNNING
WITH THE LITTLE LAWRENCE DAM

ASSUMING NO TAILWATER, NO INFLOW, AND INLET
CONTROL GOVERNS.

AVAILABLE HEAD AT [illegible] = 7.7 FT

FROM FIGURE E-8, DESIGN OF SMALL DAMS

H	H/D	Q
7.7	1.54	240
6	1.2	185
4	0.8	90
3	0.6	55
1.5	0.3	40
0	0	0

D = 2.5 FT

H	Q	AVE Q	V	ΔH	Time
7.7	240				
		198		1.5	0.6
6	185		51		
		132		1.7	1.7
4	90		34		
		72		0.8	1.4
3	55		20		
		47.5		1.5	1.3
1.5	40		11		
		20		2.1	12.7
0	0		0		

Σ = 17.7 sec

Eng Index

****
HEC-1 VERSION DATED JAN 1973
UPDATED AUG 74
CHANGE NO. 01
****

ALCYON LAKE DAM
BY R.F. BERRY
JANUARY, 1980

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	0	30	0	0	0	0	0	0	0

JOPER	NWT
3	0

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
1	0	0	0	0	0	1

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	4.00	0.00	4.00	0.80	0.500	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	113.00	123.00	132.00	141.00	0.00	0.00

LOSS DATA

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00	1.00	0.50	0.10	0.00	0.00

GIVEN UNIT GRAPH, NUHGO= 12

237. 1076. 1365. 1005. 597. 364 217. 128. 78. 46.
30. 18.

UNIT GRAPH TOTALS 5221. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

TIME	PAIN	EXCS	COMP Q
1	0.00	0.00	0.
2	0.00	0.00	0.
3	0.00	0.00	0.
4	0.00	0.00	0.
5	0.00	0.00	0.
6	0.00	0.00	0.
7	0.00	0.00	0.

8	0.00	0.00	0.
9	0.00	0.00	0.
10	0.00	0.00	0.
11	0.00	0.00	0.
12	0.00	0.00	0.
13	0.01	0.00	0.
14	0.01	0.00	0.
15	0.01	0.00	0.
16	0.01	0.00	0.
17	0.01	0.00	0.
18	0.01	0.00	0.
19	0.01	0.00	0.
20	0.01	0.00	0.
21	0.01	0.00	0.
22	0.01	0.00	0.
23	0.01	0.00	0.
24	0.01	0.00	0.
25	0.07	0.00	0.
26	0.07	0.00	0.
27	0.09	0.00	0.
28	0.09	0.00	0.
29	0.11	0.06	20.
30	0.11	0.06	86.
31	0.28	0.23	219.
32	0.28	0.23	463.
33	0.10	0.05	678.
34	0.10	0.05	680.
35	0.08	0.03	546.
36	0.08	0.03	413.
37	0.01	0.00	309.
38	0.01	0.00	213.
39	0.01	0.00	134.
40	0.01	0.00	80.
41	0.01	0.00	46.
42	0.01	0.00	24.
43	0.01	0.00	15.
44	0.01	0.00	6.
45	0.01	0.00	3.
46	0.01	0.00	2.
47	0.01	0.00	1.
48	0.01	0.00	0.
49	0.06	0.01	2.
50	0.06	0.01	10.
51	0.06	0.01	21.
52	0.06	0.01	29.
53	0.06	0.01	33.
54	0.06	0.01	36.
55	0.06	0.01	37.
56	0.06	0.01	38.
57	0.06	0.01	39.
58	0.06	0.01	39.
59	0.06	0.01	40.
60	0.06	0.01	40.
61	0.16	0.11	79.
62	0.16	0.11	180.

63	0.16	0.11	320.
64	0.16	0.11	423.
65	0.16	0.11	484.
66	0.16	0.11	521.
67	0.16	0.11	544.
68	0.16	0.11	557.
69	0.16	0.11	565.
70	0.16	0.11	569.
71	0.16	0.11	572.
72	0.16	0.11	574.
73	1.08	1.03	849.
74	1.08	1.03	1844.
75	1.30	1.25	3171.
76	1.30	1.25	4334.
77	1.63	1.58	5279.
78	1.63	1.58	6183.
79	4.12	4.07	7699.
80	4.12	4.07	10908.
81	1.52	1.47	13854.
82	1.52	1.47	13749.
83	1.19	1.14	11703.
84	1.19	1.14	9713.
85	0.09	0.04	7959.
86	0.09	0.04	5832.
87	0.09	0.04	3766.
88	0.09	0.04	2322.
89	0.09	0.04	1463.
90	0.09	0.04	943.
91	0.09	0.04	600.
92	0.09	0.04	396.
93	0.09	0.04	300.
94	0.09	0.04	243.
95	0.09	0.04	210.
96	0.09	0.04	190.
97	0.00	0.00	179.
98	0.00	0.00	140.
99	0.00	0.00	90.
100	0.00	0.00	54.
SUM	27.10	23.74	123660.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	13854	8415.	2493.	1237.	123660.
INCHES		19.57	23.19	23.97	23.97
AC-FT		4175.	4947.	5113.	5113.

RUNOFF MULTIPLIED BY 0.50

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	10.	43.
109.	231.	339.	240.	273.	207.	155.	107.	67.	40.
24.	14.	7.	3.	2.	1.	0.	0.	1.	5.
15.	14.	16.	18.	19.	19.	19.	20.	20.	20.
34.	99.	143.	211.	242.	241.	222.	278.	232.	235.
236.	247.	424.	472.	536.	467.	396.	3092.	3049.	5454.

6927.	6874.	5852.	4857.	3980.	2916.	1883.	1161.	731.	472.
300.	195.	150.	122.	105.	95.	90.	70.	45.	27.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6927.	4207.	1246.	618.	61830.
INCHES		2.78	11.59	11.98	11.98
AC-FT		2087.	2473.	2556.	2556.

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HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME
11	1	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME
0.0	0.000	0.00	1	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA
1	0	0	0.000	0.000	0.000	0.

STOR-QE=	0	22.	50.	84.	124.	170.	221.	279.	343.	413.
O.[illegible]=	0	122.	343.	632.	2161.	4720.	7533.	11624.	15806.	20414.

TIME	EOP STOR	AVG IN	EOP OUT
1	0	0.	0.
2	0.	0.	0.
3	0.	0.	0.
4	0.	0.	0.
5	0.	0.	0.
6	0.	0.	0.
7	0.	0.	0.
8	0.	0.	0.
9	0	0.	0.
10	0.	0.	0.
11	0.	0.	0.
12	0.	0.	0.
13	0.	0.	0.
14	0.	0.	0.
15	0.	0.	0.
16	0.	0.	0.
17	0.	0.	0.
18	0	0.	0.
19	0	0.	0.
20	0	0.	0
21	0	0	0
22	0	0.	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27			

28	0.	0.	0.
29	0.	5.	1.
30	1.	26.	6.
31	4.	76.	21.
32	9.	170.	51.
33	18.	285.	99.
34	27.	340.	159.
35	32.	306.	200.
36	33.	240.	211.
37	32.	181.	203.
38	30.	131.	182.
39	26.	87.	156.
40	23.	53.	127.
41	19.	32.	106.
42	16.	19.	88.
43	13.	11.	72.
44	11.	5.	59.
45	8.	2.	47.
46	7.	1.	38.
47	5.	1.	30.
48	4	0.	24.
49	3.	1.	19.
50	3.	3.	16.
51	3.	8.	14.
52	2.	12.	14.
53	2.	15.	14.
54	3.	17.	15.
55	3.	18.	15.
56	3.	19.	16.
57	3.	19.	17.
58	3.	20.	17.
59	3.	20.	18.
60	3.	20.	18.
61	4.	27.	20.
62	5.	63.	29.
63	9.	125.	49.
64	14.	196.	77.
65	19.	227.	108.
66	25	251.	143
67	29	266.	177
68	32	275.	205.
69	35	230.	236.
70	37	234.	242.
71	39.	235.	254.
72	40.	297.	263.
73	43.	356	289
74	57	672.	400
75	86.	1254	701.
76	113	1876	1738
77	120.	2407.	2760.
78	137	2864	2801.
79	148	3471.	3519
80	172	4652	4731.
81	196	6101.	5226.
82	217.	750	694.

83	199.	6363.	6325.
84	180.	5354.	5291.
85	164.	4418.	4360.
86	146.	3448.	3384.
87	127.	2399.	2331.
88	109.	1522.	1587.
89	94.	946.	1022.
90	84.	601.	651.
91	75.	386.	559.
92	65.	249.	406.
93	54.	174.	379.
94	46.	136.	309.
95	39.	113.	254.
96	33.	100.	211.
97	29.	92.	178.
98	26.	80.	150.
99	22.	58.	124.
100	19.	36.	105.
SUM			61409.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6941.	4180.	1239.	614.	61409.
INCHES		9.72	11.52	11.90	11.90
AC-FT		2074.	2459.	2539.	2539.

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RUNOFF SUMMARY, AVERAGE FLOW

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	6927.	4207.	1246.	618.	4.00
ROUTED TO	11	6927.	4207.	1246.	618.	4.00

A-14

END

DATE
FILMED

6-81

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